

Agricultural management education in Australia: genesis of a new degree programme in ecological agriculture

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While the science community continues to ask how its responsibility to society needs to be expressed in the modern world, higher education grapples with issues of its own, including issues embroiled in the perennial tug-of-war between principle and economic pragmatism. In this paper, the authors give an account of the origins and development of a new undergraduate course in 'ecological agriculture' at a regional Australian university campus. In this story, the tug-of-war is dragged strongly back to central issues of purpose and philosophy. Supplementary pragmatic information included are summaries from the feedback from students who have undergone the course and members of the relevant industry obtained through the course evaluations done in the years 2002–2005; moreover, a brief explanation as to how the obstacles faced were met in launching the programme has also been included.

Getting off the traditional 'tram tracks'

Agricultural education in Australia is either science-based (therefore referred to as a degree in agricultural science) or management-based (therefore referred to as a degree in agricultural management). In Australia, only the Marcus Oldham College in the state of Victoria and the School of Rural Management at Charles Sturt University (Orange campus)¹ in the state of New South Wales offer management-based agricultural education. Marcus Oldham College and the School of Rural Management share a similar drive—to graduate students who will be able to manage farms on sound technical and financial parameters. Academic staff of Marcus Oldham and the School of Rural Management are university trained, usually with degrees in either agricultural science or agricultural economics. The effect of such a lineage from

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science to management (Locke, 1989) is to impress on the curriculum designers of management education the importance of those characteristics that govern a science-based education. These characteristics emerge from a traditional science-based paradigm that originates in turn from the mechanistic worldviews of Descartes and Newton (Capra, 1997). According to Capra (1997, p. 6),

This paradigm consists of a number of entrenched ideas and values, among them the view of the universe as a mechanical system composed of elementary building blocks, the view of the human body as a machine, the view of life in society as a competitive struggle for existence, the belief in unlimited material progress to be achieved through economic and technological growth.

Such a view has gained currency of late. For example, Berry (1999) comments on the anthropocentric approach that places humans above all other species. In a similar vein Macy (1998, p. 28) notes the ills of the Industrial Growth Society and draws attention to the 'co-incidence' between that whole phenomenon and the evolution of modern science:

With the help of Descartes and Francis Bacon, classical science veered away from a holistic, organic view of the world, to an analytical and mechanical one. The machines we made, to extend our senses and capacities, became part of the model for the universe. Separating mechanisms from operator, object from observer, this view of reality assumed that every thing could be described objectively and controlled externally (Macy, 1998, p. 40).

We, the authors of this article, have taught across a wide range of courses, where the emphasis was primarily on the earlier described traditional science-based paradigm emphasizing technocentric approaches to agriculture and/or land management. We have challenged the reductionist scientific assumptions that drove the then existing courses in agricultural science and management in 1999 (see Raman *et al.*, 2004; Gaskell *et al.*, 2005); the outcomes of our challenge form the text of this article.

We acknowledge the academic reforms that were launched in the University of Western Sydney (UWS), Hawkesbury, in the late 1970s, and UWS's attempt to bring about systems agriculturalists. Their changes, under the then dean of agriculture, Professor Richard Bawden (Bawden *et al.*, 1984; Macadam *et al.*, 1985), involved second order change (Levy, 1986) and were designed to restructure not only the curriculum, but also the academic organization. The emphasis at UWS was on processes such as self-directed learning, experiential learning and systems thinking. Two of the authors of the present article (K. Cochrane; A. McKenzie) studied at UWS doing their postgraduate programmes and experienced the UWS model first hand. The experience was a cathartic one and, no doubt, it contributed in some way to the desire to embark on a pathway of curriculum reform at CSU (Orange), albeit many years later. What we have attempted, however, differs from the UWS model in the following ways: (1) the focus is more on change of content rather than change in process, i.e. the course taught elements of systems agriculture and experiential learning but within individual subjects rather than it permeating the whole ethos of the curriculum; (2) the course is confined by the existing unitized structure and had to

be worked within that; (3) the programme is offered externally as well as face-to-face; (4) the degree in ecological agriculture is dependent on subjects being offered through its sister course, Bachelor of Farm Management. In effect, what we have strived to do is to develop a new paradigm undergraduate programme that runs in tandem and synergistically with the other old paradigm farm management programme.

Constructing on prevailing models to mirror what existed and what needed to happen

Environmentalism and O'Riordan's model

Several models played an important role in our deliberations. Most importantly O'Riordan's (1981) continuum model of environmentalism, which separates environmentalism into either 'ecocentric' or 'technocentric' provided a useful measure for consolidating and reflecting our thinking on what existed and what needed to emerge (Figure 1).

Agriculture-related education programmes in Australia, and the degree in farm management at our school in particular, remain biased towards a technocentric approach. What appealed to us as the missing element was an approach to agricultural science or agricultural management, which embodied the ecocentric end from O'Riordan's model. O'Riordan refers to this as either representing a deep ecologist attitude to the environment, where nature is respected for its intrinsic right, or a soft technologist approach, where the emphasis is on community activity and participation in decision-making. We were keen to not follow the path of other agricultural education programmes in their efforts to supply industry with yet more technocentric 'environmental managers'. Our conviction was that Australian Agriculture would gain from an educational programme in agriculture that embraced the ecocentric end of the O'Riordan model. Certainly the state of natural-resource depletion in Australia as reflected in numerous reports over a couple of decades suggested that the existing technocentric approach to agriculture did not achieve all those desired goals.

Wilber and the validity model

Wilber (1996, p. 107) maintains that we have three fundamental languages (I, We, It(s)) and that they are often quite different, addressing different domains. These

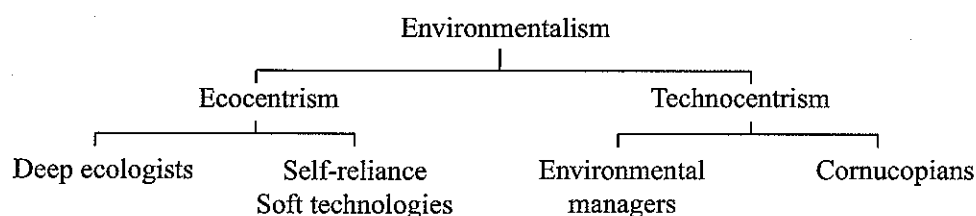


Figure 1. O'Riordan's continuum model of environmentalism (O'Riordan, 1981)

languages are arrived at from his model which comprises four quadrants based on two continuums: the 'interior–exterior' and the 'individual–collective' continuums (Figure 2). Wilber asserts that life issues can be located within one of the four quadrants, which he labels respectively as the 'I', the 'We', the 'It' and the 'Its' quadrants. Wilber (1996, p. 120) groups the 'it' and 'its' together and describes their language as objective, neutral and value free. 'I' language, on the other hand, refers to 'your' presence, 'your' consciousness, 'your' subjective awareness and so on. The third, the 'we' language, is the cultural or inter-subjective dimension. For Wilber, the lack of awareness of the language differences in the quadrants causes enormous confusion. What Wilber's model helped us identify was the degree of emphasis on the 'it'/'its' thinking in existing agricultural management and science courses with their emphasis on objectivity and a value free science. By contrast what was missing was any degree of exposure to the 'I' and 'we' language involving subjectivity either from an individual or collective perspective.

Wilber (1996) refers to the 'it/its' pathway as *flatland*, which is an appropriate metaphor for the curriculum that pervaded—and still pervades—agricultural science and agricultural management education in Australia. A pervasive reliance on the scientific paradigm exists, separating the observer from the observed, the rational from the intuitive, and the objective from the subjective. We, the authors of this article, perceived *flatland* in the current approach to agricultural science and management education, and wanted to counterbalance this focus with a more person-oriented approach.

Models of holism

The conventional Newtonian approach to science is powerful in terms of its ability to break the whole into its parts and to interpret the operations of the parts. The

		Interior	Exterior
Individual	Collective	Subjective I	Objective It
		We Intersubjective	Its Interobjective

Figure 2. Wilber's validity model (modified) (Wilber, 1996)

underlying assumption is that an understanding of the parts makes it a simple matter to build a picture of the whole. Such a reductionist trend has driven science for so long and therefore 'progress' in the modern world stands tall as a process that has delivered enormous material advantages to humankind. Unfortunately, such an approach also has cast a distinct shadow described in the following comment by the North American holistic educator John Miller (in O'Sullivan, 1999, p. 64):

Holistic education attempts to bring education into alignment with the fundamental realities of nature. Nature at its core is interrelated and dynamic. We can see this dynamism and connectedness in the atom, organic systems, the biosphere, and the universe itself. Unfortunately, the human world since the Industrial Revolution has stressed compartmentalization and standardization. The result has been the fragmentation of life.

The message is that there is an important ingredient in life that cannot be captured through reductionism. Traditional science-based education follows a reductionist approach where teaching-learning practice involves separation of entities and where a graduate's thinking skills are, therefore, tram-lined into initially perceiving and subsequently analysing life from this reductionist perspective. What we sought in the design of the new curriculum in ecological agriculture was that our graduates should not only be able to think both analytically and holistically, but also be able to distinguish between 'holistic thinking' and 'reductionist thinking'. An example of being able to distinguish between holistic and reductionist thinking is available in the thoughts of Wolfgang Goethe. Bortoft (1996, p. 328) argues that Goethe was looking for an underlying unity behind the diversity of nature, but that in order to understand Goethe's thought we must 'enter into his way of seeing'; this is not just an intellectual act but an experiential one: 'Goethe's science of the wholeness of nature can only be understood by participation in the way of seeing because this science can only be understood in its own terms. It cannot be understood by comparing it to something else'.

The distinction between intuitive thought and intellectual thought (see Figure 3) is critical when attempting to understand holism. Often scientists trained in the reductionist approach observe the parts and from this vantage point infer the whole (unity-in-multiplicity) and believe that in doing so they have been holistic. Unity-in-multiplicity (the sum of the parts) is a notion distinct from multiplicity-in-unity, which emerges from the workings of an intuitive mind. Multiplicity-in-unity relates to an emergent quality of the parts, which creates something that cannot be explained by simply adding the sum of the parts. In other words the totality of that something is vastly different from the holistic understanding of that something!

In Figure 3, Bortoft explains that the General refers to what is common and represents the workings of the intellectual mind whereas the Universal reflects a different type of knowing. Universal knowing involves an understanding that is not reached by standing back to get an overview of something, but by embracing it and knowing it from within. Bortoft (1996, p. 87) saw the Universal as the unity of the intuitive mind. The challenge we faced and tried to resolve was to capture this element in the design of our new curriculum.

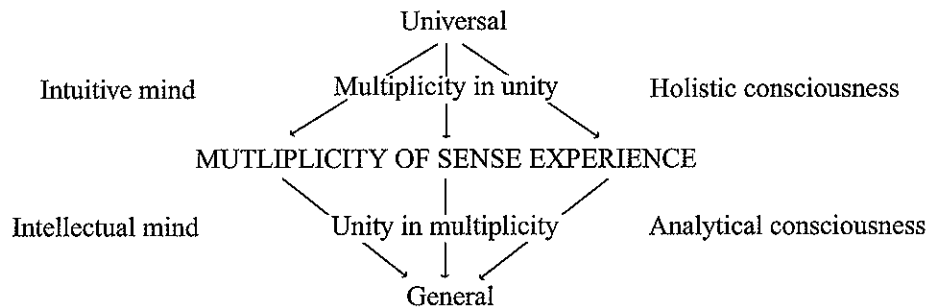


Figure 3. Bortoft makes sense of the multiplicity of sense experience (Bortoft, 1996)

Systemic thinking

Gregory Bateson refers to the criticality of 'finding the pattern that connects', which bears overtones of having the capacity to think holistically and systemically. To be able to think systemically will be to use the skills of analysis and synthesis to find the patterns that connect. We saw this as a key skill to be developed in an ecological agriculturalist and one that was complementary to the development of the intuitive pathway to knowing holism. To further our understanding of systemic thinking we examined Bateson (1973) on categories of learning, wherein Bateson based the foundation of his theory on structural logic. He defined learning as an action that denotes change (Bateson, 1973, p. 283): '... change itself denotes process, and processes themselves are subject to change'.

Bateson built onto this definition with his assertion that all learning is stochastic (i.e. involves trial and error). Bateson (1973, p. 293) then created the following 'hierarchy' of learning categories:

- Zero Learning—All acts that are not subject to correction;
- Learning I—Revision of choice within a given set of alternatives;
- Learning II—Is change in the process of Learning I. It is a corrective change in the set of alternatives from which the choice is made; and
- Learning III—Is change in the process of Learning II. It is a corrective change in the system of sets of alternatives from which the choice is made.

Further work on these categories by Cochrane (2004) indicates how Bateson's hierarchy and Wilber's holarchy² theory can be used together. The three categories of learning are not independent, but, in the language of Wilber (1996) they form a holarchy, where each category is a holon with its own functioning, but also part of the next category (a greater holon). In effect, we considered the hierarchy as a nested holarchy. Of particular interest was the role of Learning II. To quote Bateson (1973, p. 304):

If I stop at the level of Learning II, I am the aggregate of those characteristics that I call my 'character'. I am my habit of acting in context and shaping and perceiving the contexts in which I act. Selfhood is a product or aggregate of Learning II.

How does Bateson arrive at this position? According to Cochrane *et al.* (2002), Bateson's learning I is seen in terms of instrumental reward and relates primarily to the functioning of the objective and external world, while Learning II is about understanding oneself, i.e. the subjective world. In this context Learning II aligns with Wilber's subjective quadrants ('I', 'We'). Obviously the writings of Wilber and Bateson were suggesting the importance of understanding the 'self' (the subjective) as a critical component of learning. Learning II though is part of the journey to Learning III, which according to Bateson is difficult to describe. Bateson suggests that once we go beyond the context of personality and start to look at the contexts that influence the formation of our personality traits, the whole aspect of the 'self' pales into insignificance. In doing so, the individual gets released, as Bateson puts it, from 'the bondage of Learning II'. At this level (Learning III) the world is seen, as though for the first time; the learner views it from a holistic viewpoint in which 'personal identity merges into all the processes of relationships in some vast ecology or aesthetics of cosmic interaction' (Bateson, 1973, p. 306). This emergence into a new worldview resonated with the course designers, particularly given our intention to generate ecological thinkers.

Cochrane (2004) refers to the power of dualistic thinking in reference to Bateson's model and of a model constructed by Chakraborty (1998) in reference to values in management. According to Cochrane (2004), dualistic thinking or reductionist thinking or the power to separate humans from their environment is an outcome of Learning I. Cochrane (2004) associates this level and its emphasis on understanding the external world with the classical science paradigm and reductionist thinking, which is one of its characteristics. As the mind progresses from Learning I into the subjective sphere (Learning II) and from there into a world without boundaries (Learning III), the meaning maker achieves integrative, holistic thinking that is characteristic of 'ecological literacy' (Sewall, 1995). While this might read like a maze of levels and stages the existence of the various models actually acted as a map to direct our thinking and to ensure that the course emerged with the potential to create holistic thinkers who were well equipped to play a significant role as ecological agriculturists.

The needed pedagogy

Bateson's model and particularly his Learning II category drew our attention to the need to develop the person as a key component in developing an ecologically literate graduate. From an understanding of such a need we recognized three fundamental principles that the new ecological agriculture programme should express:

- a firm belief that knowledge is about attributing meaning to the world including oneself; it is not a commodity which exists independently of people that can be stored and transmitted;
- strong support for the notion that education is about the development of the whole person and not just one's intellectual potential; and
- an expectation that, regardless of the student's understanding and worldview on entry into the programme, the exploration of ideas and the learning processes

will constitute a transformative learning (Mezirow & Associates, 1990), even spiritual journey.

These parameters indicate a different approach to education in which learning is a process where a person tests his/her theory out on the world in order to make sense of that world. Here process means engagement between theory and practice and is dependent on trial and error procedures. In the process of making sense of the world and of building information into one's constructs, change occurs, which in itself leads to development of self. Through this process, learning takes place. This approach resonates with Heron (1996, p. 33) and his approach to holistic knowledge. Heron's holistic knowledge rests on systemic logic which holds that intellectual or propositional knowledge, together with the validating principles internal to it, are interdependent with three other kinds of knowledge: practical knowledge; presentational knowledge (intuitively grasping imaginal patterns); and experiential knowledge. The sense of discovery underlying this approach to learning reflects a constructivist approach to learning where the student constructs his/her reality. The need to explore and to experiment suggests a preparedness to engage in what Argyris (1985) refers to as double-loop learning where assumptions and beliefs are continually challenged and reviewed. The metaphor that emerges is one of change and growth where the old is continually inspected and perhaps tested.

At this stage we could see a pathway to creating a degree in ecological agriculture to achieve the programme aims and outcomes (Appendix). We knew that we had to give our students the facts about the external world that they needed to know. We knew that we had to take them into the realm of self-knowledge. And we also knew that we had to create programmes that enriched their exposure to holism and intuitive knowing. At the end of this process we felt we would be close to creating an enabled graduate with the capacity to think holistically about agriculture, and also to do so with sensitivity. Fundamentally, we sought to generate a capacity to think on different levels and to understand the model that defines these levels. In one sense we were creating an agricultural manager who could concertina all four categories of Bateson's learning into one and think as one. In other senses we wanted them to be able to separate the levels and think of an issue through inside one of the separated levels. We saw this 'cognitive dexterity' (McKenzie, 2001) as an important learning outcome of our curriculum.

Development of ecological literacy

One part of the process of developing an ecological agriculturist is to create a language that is specific to that discipline. If conventional agriculture grew out of the domain of reductionist science as influenced by the thoughts of Newton and Descartes, then could it be that the presence of a new physics in quantum theory beckons the emergence of a different approach to agricultural production?

A review of some of the paradoxes that surround quantum science will be in order here. If conventional science is about predictability, then quantum science is its

opposite. When measuring subatomic particles at the quantum level, the particles behave sometimes like a particle and at other times like a wave. What form it takes depends on the way the experiment is devised (Broomfield, 1997). The suggestion that emerges here is that meaning making (making sense of self in the world, McKenzie, 2000) now occurs against a backdrop of pluralist and divergent sets of ground rule assumptions about reality. Fritjof Capra's *The Web of Life* explores this idea and contains a chapter dedicated to ecological literacy. Capra's principles are founded on quantum theory and are embellished by the concepts of Maturana and Varela (autopoiesis), Prigogine (dissipative structures), Lovelock (Gaia theory) and Poincare (chaos theory). There are three principles (Capra, 1997, p. 295):

1. *Interdependence*: All members of an ecological community are interconnected in a vast and intricate network. The need to understand relationships means a shift in perception from parts to the whole, from objects to relationships and from content to patterns.
2. *Flexibility*: An ecosystem has multiple feedback loops to enable the system to operate efficiently and effectively. The greater the flexibility the more the system is able to adjust to changes in the environment.
3. *Diversity*: In ecosystems, the complexity of the network is a consequence of its biodiversity and thus a diverse ecological community is a resilient community.

We identified the need to weave these principles into the content of the curriculum and also to enable ways for these qualities to emerge in our students as they pursued their particular pathways through the programme. Given that we did not have much flexibility to create a new course consisting of 24 new, interdisciplinary subjects, we had to draw subjects from other courses already existing in the School of Rural Management and such an action limited possible novelties. Nevertheless, we were able to build reflective learning as a process in the overall curriculum, through engagement of students in what we refer to as the Capability Education Programme (Cochrane *et al.*, 2002). Briefly, the Capability Education Programme involves students maintaining a journal (a portfolio) of their evidence of achievement in relation to graduate attributes and this portfolio is evaluated prior to graduation.

Curriculum design

An outline of the course profile including core subjects is available in the Charles Sturt University website (Charles Sturt University, 2006). The intent here is to explain and illustrate some of the design elements.

- By placing emphasis on the 'I' and 'we' components, following Wilber's model, we needed to include subjects and pedagogical approaches that enhanced student development. This has been achieved through the inclusion of subjects such as *Introduction to Ecological Agriculture*, *Managing Yourself and Others*, *Managing Change (Inquiry Tools)*, *Managing Change (Industry Project)* and *Human Ecology* as core subjects of learning. In addition, full-time internal students are required to

make a 10–15 minute presentation on their ecological philosophy at the end of each year of study. Each presentation is video-recorded so that staff and students can observe the evolution in each student's understanding over the 3 years of the programme. In the core subjects especially, experiential learning is an important pedagogical strategy, which assists students to enter more fully into the 'I–We' quadrants as they construct their worlds of meaning. Students are expected to build their knowledge and take ownership of their learning which is the cornerstone of constructivist learning.

- The objectivist components of Wilber's model were advanced through such subjects as *Applied Ecology*, *Agricultural Ecology*, *Soil Resource Management*, *Organic Agriculture* and *Biodynamics* (Table 1).
- The course places significant emphasis on the development of the person. We maintain the important role that emotional intelligence (Goleman, 2004) plays in life and through subjects such as *Managing Yourself & Others*, *Managing Change (Inquiry Tools)* and *Human Ecology* we were able to encourage this aspect of our students' holistic development. Emotional intelligence is further developed via the Capability programme and the portfolio of evidence that each student maintains. A central feature of the Capability programme is a portfolio of evidence that the students keep in relation to seven graduate attributes (referred to as capabilities). This portfolio is maintained over the 3 years of internal study only (usually not taken up in the distance delivery mode involving part-time learners) and then, at the conclusion to their degree studies, students submit their portfolio of evidence demonstrating their progress in cultivating the seven capabilities. The portfolio of evidence forms the basis for a 30 minute interview by an industry representative and an academic. On the basis of this interview and the portfolio, students receive a recommendation to proceed to graduation.
- In placing emphasis on social ecology in the design of the curriculum, the course designers were cognisant of the need for students to develop skills of scientific interpretation and decision-making. The course, therefore, requires students to study subjects that are framed in a more traditional scientific way such as *The Biological Environment*, *Applied Ecology* and *Agricultural Ecology*.
- The course is interdisciplinary and transdisciplinary and therefore complies with the tenet of what constitutes a sustainability education as outlined by Moore (2005). It comprises a combination of subjects from both the hard and soft sciences and, through subjects such as *Human Ecology*, it is able to provide a transdisciplinary overview. This is greatly reinforced through the Capability Portfolio where students relate their learning from the 24 subjects studied back to seven graduate attributes and document their learning in relation to these attributes. This process enables students to re-contextualize their learning into a framework that industry has identified as representing the type of attributes needed in the workplace.

Bateson's model acts as a meta-guide to the overall programme. Students learn about operational issues in relation to the objective world through studying a range of subjects relating to the management of soils, plants and livestock (Learning I).

Table 1. Curriculum constructed on Bateson's categories of learning*

Bateson's categories of learning	Subjects employed at each level	Learning outcomes	Evidence of achievement
Level 1 Zero learning	No subject is designed to achieve this but such an outcome may well be a result of poor pedagogical approaches	Conditioned responses	Memorized and ultimately forgotten imperfectly recalled over time
Level 2 Learning I Operational Objective External Duality existing in relationship to the environment	Year 1 Plants in Agriculture The Biological Environment Introduction to Management Introduction to Ecological Agriculture	Basic understanding of ecosystems and of management A study of the history of agriculture; Awareness of alternative paradigms in agriculture	Portfolio of evidence; Writing in the 3 rd person; Evidence collected from subjects studied
Level 3 Learning II Subjective Development of self Emotional intelligence development	Year 2 Applied Ecology Soil Resource Management Year 3 Agricultural Ecology Year 2 Managing Yourself & Others Managing Change (Inquiry Tools) Year 3 Managing Change (Industry Project)	Studies the functioning of ecosystems and impact of human activity Application of eco systems to agriculture The development of self-knowledge and interpersonal skills; The development of change management capabilities The engagement of qualitative research skills in change management to manage complexity	Portfolio of evidence; Writing in the 1 st person; Evidence of personal engagement and introspection

Table 1. *Continued*

Bateson's categories of learning	Subjects employed at each level	Learning outcomes	Evidence of achievement
Level 4 Learning III Connected Holistic Unity Final determination of graduate attributes	Year 3 Human Ecology	Studying the empathetic relationship between humans and the environment. A study of values systems and modes of thinking	Portfolio of evidence; Writing in the 2 nd person; Evidence collected from student's major assignment in <i>Human Ecology</i> Assessment of portfolio by interview involving industry prior to graduation

*Subjects included in this table are core (compulsory) within the 24 subject degree programme. Elective subjects have not been included.

This level represents the default approach of most university level courses dedicated to agricultural education. The problem lay in encouraging students to explore Learning categories II and III. Subjects which foster 'self' knowledge became the vehicle for fostering a Learning II development: *Managing Yourself & Others*, with its focus on self-knowledge; *Managing Change (Inquiry Tools)* with its emphasis on soft-systems methodology for developing the ability to understand and solve complex issues; and *Human Ecology* with its emphasis on eco-psychology and eco-philosophy. The challenge, however, was with achieving Learning III and the development of holism. The pathway to this end could not be achieved by the rational and analytical modes, but through their opposite—imaginative and intuitive—modes. This has been achieved through the development of an assignment in *Human Ecology* in which students have to engage in a second person relationship with the environment ('I'/'Thou') and to document it using the medium they have selected for this purpose. Students use video, photography, music, sculpture, poetry or art to convey this relationship. Their documentation is based on the tenets of ecological literacy, which are similar to those of Capra, but more appropriate to this course (Sewall, 1995).

Obstacles met

Prior to the design of the curriculum we consulted local industry on what they wanted included in the programme. Forty representatives of industry were chosen and surveyed. A majority (70%) strongly supported our fresh approach to agricultural education. A minority preferred an applied and pure science approach. One senior academic objected to the use of the term 'ecology' in 'social ecology', asserting that ecology is all about the science of the environment, rather than the 'science' of people and their interactions with the environment.

Because the ecological agriculture programme would be an extension of the suite of undergraduate programmes already being offered, it was not perceived as a threat but rather as a mechanism for broadening the student intake across the campus and the region. It meant that the degree could be introduced without the need to employ new staff. In this sense, administrators and academics welcomed the new degree. In many ways the change was 'First Order' (Levy, 1986) and did not represent a serious threat to the *status quo*. Oddly enough, we were able to engage in Second Order change, sometimes of a cathartic nature, via the content and processes employed in the curriculum.

In the context of obstacles faced, we need to emphasize that the School of Rural Management at CSU (Orange) follows a management approach to agriculture and natural resource management. Principles of science are used to the extent appropriate for a management-based training and not to the extent found in an agricultural science course. The management focus enabled the course to introduce notions such as social ecology without a ground swell of objections; if our School had had a science focus we would have expected overt resistance to our mainstreaming of subjective awareness in our teaching.

Student and industry responses

Approximately 100 students are enrolled as of 2006, most of them from Australia (one from Spain) and the majority study via a distance learning mode. Students are enthusiastic about the course as the following sample of comments collected in 2005 as part of the course review would indicate:

'This course is unique, thought provoking, and appealing'; 'an innovative forward thinking course'; 'the course is brilliant, I love its flexibility and am so proud to explain to people what I study'; 'it is an excellent course that I feel has prepared me very well for making a contribution to the sustainability of rural communities ... it has far exceeded what I expected at the beginning of my studies'; 'I am very happy with the course and feel I am getting a top notch education'.

One area of concern is that students of ecological agriculture share subjects with students from the Bachelor of Farm Management where the emphasis is on an economic rationalist approach to agriculture. This does create some level of resentment among students of ecological agriculture in that they are not receiving information in alignment with their beliefs about the environment. Our pragmatic response to this is to demonstrate the importance of being able to speak many 'languages'; we reiterated that while being equipped to be an ecological agriculturalist, learning to converse the language of conventional agriculture is also important.

Feedback from a subsequent survey of industry (25 responses) was no less enthusiastic. A sample from these responses is outlined in Table 2. (Names and addresses are withheld for reasons of anonymity.)

Conclusion

Curriculum design of educational programmes often evolves and does so in a haphazard fashion and in ways that reflect the curriculum interests of its staff rather than reflecting the needs of the people and industry. Once in place these patterns of subjects are difficult to change so that the tram lines of content and educational processes are set in concrete. What prevailed in the case of the degree in ecological agriculture was a preparedness to broaden the base and consider the place of humans in the environment. The underlying assumption was that humans are a part of the world in which we live and not *the* part. To be seen as a cog in the wheel of life rather than *the* cog requires an adjustment to the curriculum to allow for a more sensitive (attuned and wise) graduate to emerge. Undoubtedly a key factor in enabling curriculum change to occur was the capacity to draw on conceptual models which illuminated where we were and where we needed to go. In the absence of powerful models as a focus for debate the direction of change is often at the mercy of those who fill the most powerful positions in an academic institution.

One of the difficulties facing curriculum designers in centres of agricultural education is convincing what is probably still the overwhelming majority of colleagues that more and more of science and science alone does not generate a person with a better education. This point is alluded to by Korfiatis (2005, p. 243) who quotes

Table 2. Responses to a survey of industry

State Landcare Coordinator	It is better suited to the realities of agricultural in today's world because of its ecocentric and holistic approach, its focus on teaching analytical skills and ability to relate to other.
National Landcare Coordinator	A barrier often exists with the integration of production and conservation farming activities in people's everyday thinking processes. The degree in ecological agr' addresses this.
Organic farmer	Nice balance of philosophy, agriculture, ecology, psychology and optional streams.
Organic consultant	This course seeks to create an entirely different approach to agriculture. The overall content and focus is quite exciting and refreshing.
Environmental consultant	For far too long have agricultural courses been centred on science and worst still, centred around the separate aspects and specializations of science with little attempt to integrate the science disciplines. This ecological approach enables the sciences to be integrated, but, more importantly, it places the farm manager in a socio-economic context.
Coordinator of the Masters programme, Schumacher College, UK.	A particular strength of the course is its holistic nature in that it incorporates ways of non-intellectual knowing alongside strongly analytical/rational epistemology.
Academic University of Western Sydney, Hawkesbury	The philosophical and theoretical foundation of the programme is sound. The subjects are well chosen, and the pedagogical approach, which emphasizes experiential, project based and whole person learning, is appropriate.
School of Social Sciences, University of Newcastle, Australia	This is an extremely interesting approach to agricultural education. I like the mix of hands on subjects in agriculture and the science of agricultural systems with more reflective courses on social context, on processes of social and personal change.

Ashley and his conclusion that a reflexive modernity curriculum in science needs to include 'philosophy, values clarification and citizenship skills together with elements of risk literacy and an understanding of the limits of science'. We interpret this as a move to include elements of subjectivity in the curriculum and given our experiences as outlined we wholeheartedly agree. A human-being comprises many facets—intellectual, emotional and spiritual—all of which need to be developed through a curriculum that allows these elements to emerge and mature. Making allowance for the emergence of the emotional and the spiritual in people is not difficult. The difficulty lies in convincing others that this has to happen in the first place.

Notes

1. Was known as the Orange Agricultural College between 1975–2000, known as the Faculty of Rural Management, The University of Sydney between 2000–2005.
2. Holarchy is a term used to refer to hierarchy. A natural hierarchy is simply an order towards increasing wholeness such as: particles to atoms to cells to organisms or letters to words to

sentences to paragraphs. The whole of one level becomes a part of the whole of the next. Each component in the examples chosen represents a holon, which is in turn a sub-holon of a greater holon (Wilber, 2000).

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Appendix

Course aims

This course explores the nexus between social, ecological and business skills and knowledge to produce graduates well suited to a wide range of roles, principally in

- the management of alternative agricultural enterprises, e.g. biological farming;
- mainstream enterprises that are moving towards an agro-ecological focus;
- the nexus between agriculture and land resource management, e.g. Landcare; and
- government agencies involved with natural resource management.

The particular emphasis of the course is four-fold:

1. The application of ecological knowledge and skills to the management of farming, grazing and related agricultural systems (i.e. ecological thinking).
2. The development of a high level of managerial capability incorporating communication, interpersonal skills and integrated project management, as well as holistic approaches to situation improvement.
3. The acquisition of an ecological ethic based on the principles of environmental stewardship and an ecocentric approach to human–environment relationships.
4. Developing a student's ecological literacy through
 - placing emphasis on ecological philosophy;
 - emphasizing holistic thinking as an overarching process which embraces reductionist thinking;
 - enhancement of their imagination and empathy skills; and
 - exploring their sense of place in evolutionary and geographical terms.

Course outcomes

Graduates will make an effective contribution, as managers, towards more sustainable agri-management systems, through the development of ecocentric thinking, the knowledge of ecology as it applies to agriculture and the skills of situation improvement. Specifically, the graduate will develop:

- applied knowledge and skills in agricultural management as determined by the tenets of ecological thinking;
- knowledge of the principles of the science of ecology and of their application to the planning and management of agri-production systems;
- an ethic of land stewardship and an ability to apply ecocentric thinking as a central paradigm for developing more sustainable forms of agriculture;
- environmentally responsible practices to minimize the environmental impacts of agriculture and ensure judicious use and re-use of renewable and non-renewable resources; and
- effective facilitation, project management and inquiry skills to assist in managing change in the agricultural sector and the development of new approaches.